Claims

We claim:

1. A tool device comprising:

a detachable tool member having a tool head and an attachment shaft with a locking engagement portion;

a handle; and

a coupler device fixedly attached to the handle and having a locking structure selectively moveable between locking and release conditions and being carried by a coupler body having an inner wall defining a cavity that is accessible via a cavity aperture and terminating with a terminal wall opposite the cavity aperture, the cavity being dimensioned and shaped to receive the attachment shaft, a first locking member carried by the inner wall for cooperative engagement with the attachment shaft to temporarily move the locking structure to its release condition when the attachment shaft is inserted into the cavity, and a second locking member carried by the inner wall for cooperative engagement with the locking engagement portion and the locking structure when the attachment shaft is inserted substantially into the cavity to accommodate movement of the locking structure to its locking condition to inhibit removal of the shaft from the cavity.

2. The device as claimed in claim 1 further comprising a bias structure resiliently urging the locking structure to its locking position.

3. The device as claimed in claim 1 wherein the coupler body includes first and second radial bores disposed in the internal wall, the first and second radial bores being rotationally and axially spaced apart relative to each other.

4. The device as claimed in claim 3 wherein the first locking member includes a first detent ball disposed within the first radial bore.

5. The device as claimed in claim 4 wherein the second locking member includes a second detent ball disposed within the second radial bore, the first detent ball having a diameter less than the second detent ball.

6. The device as claimed in claim 5 wherein the engagement shaft includes an end having a chamfered edge adapted to abut the first detent ball prior to abutment with the second detent ball when the engagement shaft is inserted into the cavity.

7. The device as claimed in claim 2 wherein the coupler body includes first and second exterior surfaces having respective first and second outer diameters, the first and second exterior surfaces being integrally connected with a substantially frustoconical shoulder portion.

8. The device as claim in claim 7 wherein the first outer diameter is greater than the second outer diameter.

9. The device as claimed in claim 8 wherein the locking structure includes a coupler sleeve disposed around the coupler body and being longitudinally movable relative thereto and having an internally disposed sleeve ramp inclined at an angle approximating that of the frustoconical shoulder portion and inwardly terminating at a base portion thereby defining an annular backstop between the base portion and the coupler sleeve being substantially perpendicular to the longitudinal axis of the coupler body.

10. The device as claimed in claim 9 further comprising an annular sleeve guide circumferentially disposed around the coupler body adjacent to the handle and adapted to slideably support the coupler sleeve.

11. The device as claimed in claim 10 wherein the bias structure includes a compression spring circumferentially disposed around the coupler body between the sleeve guide and the backstop.

12. The device as claimed in claim 1 wherein the cavity includes a key disposed on the inner wall adjacent to the cavity aperture.

13. The device as claimed in claim 12 wherein the attachment shaft includes a keyway for cooperative engagement with the key to axially guide the attachment shaft into the cavity.

14. The device as claimed in claim 1 wherein the locking engagement portion includes a circumferential channel disposed on the engagement shaft.

15. The device as claimed in claim 14 wherein the circumferential channel has a substantially arcuate cross-sectional shape.

16. The device as claimed in claim 1 wherein the coupler body includes a circumferential channel disposed on the inner wall adjacent to the cavity aperture.

17. The device as claimed in claim 16 wherein the circumferential channel includes an annular seal disposed therein and adapted to be in substantial seal-like engagement with the engagement shaft when the engagement shaft is inserted substantially into the cavity.

18. The device as claimed in claim 1 wherein the cavity includes a compression spring disposed adjacent to the terminal wall and adapted to compress when the engagement shaft is inserted substantially into the cavity.

19. A coupled device, comprising, in combination:

an attachable member having an attachment shaft with a locking engagement portion;

a coupler device having a locking structure selectively moveable between locking and release conditions and being carried by a coupler body having an inner wall defining a cavity that is accessible via a cavity aperture and terminating with a terminal wall opposite the cavity aperture, the cavity being dimensioned and shaped to receive the attachment shaft, the inner wall carrying a first locking member for cooperative engagement with the attachment shaft to temporarily move the locking structure to its release condition when the attachment shaft is inserted into the cavity and a second locking member for cooperative engagement with the locking engagement portion and the locking structure when the attachment shaft is inserted substantially into the cavity and the locking structure is moved to its locking condition; and

a bias structure resiliently urging the locking structure to its locking condition.

20. The device as claimed in claim 19 wherein the coupler body includes first and second radial bores disposed in the inner wall, the first and second radial bores being rotationally and axially spaced apart relative to each other.

21. The device as claimed in claim 20 wherein the first locking member includes a first detent ball disposed within the first radial bore.

22. The device as claimed in claim 21 wherein the second locking member includes a second detent ball disposed within the second radial bore, the first detent ball having a diameter less than the second detent ball.

23. The device as claimed in claim 22 wherein the engagement shaft includes an end having a chamfered edge adapted to abut the first detent ball prior to the second detent ball.

24. The device as claimed in claim 19 wherein the coupler body includes first and second exterior surfaces having respective first and second outer diameters, the first and second exterior surfaces being integrally connected with a substantially frustoconical shoulder portion.

25. The device as claim in claim 24 wherein the first outer diameter is greater than the second outer diameter.

26. The device as claimed in claim 24 wherein the locking structure includes a coupler sleeve disposed around the coupler body and being longitudinally movable relative thereto and having an internally disposed sleeve ramp inclined at an angle approximating the frustoconical shoulder portion and inwardly terminating at a base portion thereby defining an annular backstop between the base portion and the coupler sleeve being substantially perpendicular to the longitudinal axis of the coupler body.

27. The device as claimed in claim 26 further comprising an annular sleeve guide circumferentially disposed around the coupler body and adapted to slideably support the coupler sleeve.

28. The device as claimed in claim 27 wherein the bias structure includes a compression spring circumferentially disposed around the coupler body between the sleeve guide and the backstop.

29. The device as claimed in claim 19 wherein the cavity includes a key disposed on the inner wall adjacent to the cavity aperture.

30. The device as claimed in claim 29 wherein the attachment shaft includes a keyway for cooperative engagement with the key to axially guide the attachment shaft into the cavity.

31. The device as claimed in claim 19 wherein the locking engagement portion includes a circumferential channel disposed on the engagement shaft.

32. The device as claimed in claim 31 wherein the circumferential channel has a substantially arcuate cross-sectional shape.

33. The device as claimed in claim 19 wherein the coupler body includes a circumferential channel disposed on the inner wall adjacent to the cavity aperture.

34. The device as claimed in claim 33 wherein the circumferential channel includes an annular ring disposed therein and adapted to be in substantial sealing engagement with the engagement shaft when the engagement shaft is inserted substantially into the cavity.

35. The device as claimed in claim 19 wherein the cavity includes a compression spring disposed adjacent to the terminal wall and adapted to compress when the engagement shaft is inserted substantially into the cavity.

36. A coupler device comprising:

a coupler body having a cavity and first and second exterior surfaces, the first and second exterior surfaces being integrally connected with a substantially frustoconical shoulder portion, the cavity having at least one internal wall;

first and second radial bores disposed in the internal wall respectively at rotationally and axially spaced-apart locations relative to each other;

a first detent ball disposed within the first radial bore;

a second detent ball disposed within the second radial bore, the first detent ball having a diameter less than that of the second detent ball; and

a coupler sleeve disposed around the coupler body and being longitudinally movable relative thereto between locking and release conditions and having an internally disposed sleeve ramp inclined at an angle approximating that of the frustoconical shoulder portion

and inwardly terminating at a base portion thereby defining an annular backstop between the base portion and the coupler sleeve.

37. The device as claimed in claim 36 further comprising a bias structure resiliently urging the coupler sleeve to its locking position.

38. The device as claimed in claim 37 further comprising an annular sleeve guide circumferentially disposed around the coupler body and adapted to slideably support the coupler sleeve.

39. The device as claimed in claim 37 wherein the bias structure includes a compression spring circumferentially disposed around the coupler body between the sleeve guide and the frustoconical shoulder portion.

40. A method of coupling an attachment member having a shaft and a locking engagement portion to a coupling device having a cylindrical cavity with an inner wall, a locking structure including a sleeve and first and second locking members being rotationally and axially spaced apart relative to one another, the locking structure being movable between a locking condition obstructing the cavity and a release condition, the locking structure being biased to the locking condition, the method comprising:

inserting the shaft partially into the cavity until it engages the first locking member; then

inserting the shaft further into the cavity to cam the first locking member radially outwardly so that the first locking member abuts the sleeve to move the locking structure to its release condition; then

substantially inserting the shaft into the cavity permitting the first locking member to release the locking structure to return to its locking condition thereby causing the second

locking member to move into cooperative engagement with the locking engagement portion.